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Statewide Method of Measuring Ambulance Patient Offload Times

Howard D. Backer, MD MPH, Nicole T. D'Arcy, MD, Adam J. Davis, BS, Bruce Barton, BS, Karl A. Sporer, MD

Abstract

Objective: Ambulance patient offload time (APOT) also known colloquially as "Wall time" has been described in various jurisdictions but seems to be highly variable. Any attempt to improve APOT requires the use of common definitions and standard methodology to measure the extent of the problem. **Methods**: An Ambulance Offload Delay Task Force in California developed a set of standard definitions and methodology to measure APOT for transported 9-1-1 patients. It is defined as the time "interval between the arrival of an ambulance at an emergency department and the time that the patient is transferred to an ED gurney, bed, chair or other acceptable location and the ED assumes responsibility for care of the patient." Local EMS agencies voluntarily reported data according to the standard methodology to the California EMS Authority (State agency). **Results**: Data were reported for 9-1-1 transports during 2017 from 9 of 33 local EMS Agencies in California that comprise 37 percent of the state population. These represent 830,637 ambulance transports to 126 hospitals. APOT shows significant variation by EMS agency with half of the agencies demonstrating significant delays. Offload times vary markedly by hospital as well as by region. Three-fourths of hospitals detained EMS crews more than one hour, 40% more than two hours, and one-third delayed EMS return to service by more than three hours. **Conclusion**: This first step to address offload delays in California consists of standardized definitions for data collection to address the significant variability inherent in obtaining data from 33 local agencies, hundreds of EMS provider agencies, and 320 acute care hospital Emergency Departments that receive 9-1-1 ambulance transports. The first year of standardized data collection of ambulance patient offload times revealed significant ambulance patient offload time delays that are not distributed uniformly, resulting in a substantial financial burden for some EMS providers in California. **Key words:** emergency service; hospital/statistics & numerical data; ambulances/organization & administration; ambulances/supply & distribution; crowding; health services accessibility/statistics & numerical data

PREHOSPITAL EMERGENCY CARE 2018;0:000–000

Introduction

Reliability and availability of emergency medical services (EMS) and emergency departments (ED) are a key component of the safety net of the health care system. Emergency departments in California on average see 12.5 million patients annually of which 20–25% arrive by ambulance (1). Emergency department overcrowding has been a well-documented phenomenon for decades, associated with adverse clinical outcomes (2–6). There has been some research documenting the impacts of overcrowding and offload delay that include delayed patient treatment with pain medications and antibiotics as well as longer hospital lengths of stays (7–13). In the past, the diversion of ambulances away from impacted emergency departments was commonly used in California to mitigate this issue but, ultimately, was considered an inadequate response to a hospital based problem. Recently, many jurisdictions have significantly limited or eliminated the use of ambulance diversion (6, 14–18). In the past few years, oversaturated EDs have developed a growing problem with the timely transfer of care of these ambulance transported patients from EMS to the ED staff. The combination of a lack of beds and insufficient staff has caused an increase in ambulance patient offload time (APOT) also known colloquially as "Wall time" (19–22). The ambulance that is delayed in the ED decreases advanced life support coverage in the community, increases response times to critical cases, and adds to the financial stress of our EMS systems. A national study found that the wait time for ambulances has doubled from 20 minutes in 2000 to over 45 minutes by 2006 (1, 19). A 2004 study in Los Angeles revealed delays of 2–4 hours (20). In 2012,

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Riverside and San Bernardino counties measured approximately 20,535 total delay hours accounting for $3 million in lost unit hours during that year. A similar measurement in Sacramento Metro Fire Department accumulated 17,345 hours of delays in patient offload time with an estimated system cost for this time of $2.6 million (1). In 2011, the National Association of EMS Physicians published a position paper outlining their concern that ambulance offload delays compromise patient safety (21).

An Ambulance Offload Delay Collaborative consisting of the California Hospital Association, the California Emergency Medical Services Authority (EMSA), and the Emergency Medical Services Administrators Association of California began work in 2013 (1). A broad range of stakeholders were convened to identify the problems and develop an action plan and strategies for local emergency medical services agencies to work with their hospitals to reduce ambulance patient offload delays. A qualitative survey of California EMS agencies in 2013 demonstrated that the offload delay problem varies by county. A number of these EMS agencies that account for 70% of the state's population considered this to be a significant problem (1). The Collaborative found regional exaggerations and hospital variations in delays. Some EMS systems had begun work to resolve delays and others had not yet begun to collect this data.

The "Toolkit to Reduce Ambulance Patient Offload Delays in the Emergency Department" was published in 2013 (1). Its main goals were to propose the need for standardized language, definitions, and metrics and to provide hospitals with a framework for quality improvement to address the issue.

In response to growing strain on EMS system resources and provider frustration, the California Fire Chiefs Association sponsored a bill supported by California Professional Firefighters and Paramedics Plus to address this issue. California Assembly Bill 1223 (O'Donnell, Chapter 379, Statutes of 2015) directed EMSA to develop a statewide standard methodology for the calculation of ambulance offload times (23). Local EMS agencies must use these specifications when collecting and reporting data from EMS provider agencies; however, local EMS agencies were not required to measure or report their APOT data to the EMSA. This manuscript will describe the standardized definitions and share the results that have been reported to the EMSA to date.

METHODS

California EMS is a two-tiered system with the state agency (EMSA) responsible for coordination, regulation, and oversight of the EMS system, and 33 local EMS agencies (26 single county and 7 multicounty) with responsibility for the direct implementation and integration of the local EMS system, including specialty care hospital designation, medical and destination protocols. Both state and local EMS agencies have a responsibility to use data for quality improvement.

A task force, as proscribed by the previously cited statute, consisting of representatives from the California Hospital Association, the California EMSA, and the Emergency Medical Services Administrators Association of California were convened to develop a set of standard definitions and methodology to measure ambulance offload delay. These intervals were based on operational considerations agreed upon by the task force. More thorough technical definitions as well as a methodology guidance document are available (Appendices 1–4). Data for initial reporting are limited to 9-1-1 response and excludes inter-facility transfers, 7-digit response, police transports, and air medical transports.

The ambulance patient offload time (APOT) for each transported 9-1-1 patient is defined as the time "interval between the arrival of an ambulance at an emergency department and the time that the patient is transferred to an ED gurney, bed, chair or other acceptable location and the ED assumes responsibility for care of the patient." This is most commonly captured electronically in the patient care record from the recorded time on arrival at the hospital (defined as wheel stop at the location where the patient is off-loaded) to the time of the electronic signature of the triage nurse after the physical removal of the patient from the ambulance gurney (Appendix 1). We chose the 90th fractile to express this measure rather than another statistical measure such as the mean, because any standard that is set locally or at the state level must account for periods of system surge and allow greater variability for a predetermined percent of runs.

These data are reported to the EMSA as aggregate values, stratified by hospital. Only agencies that reported data for the entire year of 2017 were included because they had the opportunity to check data validity, work with providers for accurate data entry, and make necessary corrections in data extraction from their NEMSIS 3.4 compliant systems; however, reported runs may not include all of the EMS provider agencies operating within the jurisdiction of a given EMS agency. The two main data points collected are defined as follows:

1. APOT-1 is the 90% fractile in minutes for transfer of care of ambulance patients from 9-1-1 transports and the number of ambulance transports.
2. APOT-2 is the percentage of ambulance patients transported by EMS personnel with an APOT:

Table 1. Total hours of delay greater than 20 minutes and financial cost of APOD by local EMS agency per month and total for 2017

	Alameda	Central California	Contra Costa	Orange	North Coast	Riverside	Sacramento	Santa Clara	Ventura	Monthly Systemwide Cost for Hours of Delay for 2017
Jan	1,884.0	3,922.5	1,302.0	668.0	1,258.5	2,742.5	1,225.5	940.5	147.0	$2,198,118
Feb	1,117.5	2,912.5	1,015.5	392.5	972.0	2,492.5	991.5	501.5	161.5	$1,646,892
March	1,265.5	3,091.5	1,005.0	482.0	1,147.0	2,887.5	843.5	553.5	161.5	$1,784,172
April	1,321.0	2,690.5	1,033.5	602.5	1,108.5	2,566.5	1,000.0	486.5	156.5	$1,710,618
May	1,325.0	3,010.0	899.0	440.5	1,125.5	2,521.5	1,423.0	577.0	153.5	$1,790,100
June	1,204.0	2,445.0	787.5	332.0	892.0	2,743.0	1,214.5	576.5	129.5	$1,610,544
July	1,071.0	2,348.5	807.0	400.0	968.0	2,601.5	961.0	532.0	121.5	$1,530,438
Aug	1,027.0	2,349.0	791.0	356.0	923.0	3,085.0	941.0	540.0	102.5	$1,577,862
Sept	1,102.5	2,817.5	873.0	359.0	973.5	3,007.5	1,099.5	553.0	103.0	$1,698,606
Oct	1,145.5	2,922.5	922.0	361.0	914.0	3,054.0	990.5	541.5	142.5	$1,714,986
Nov	1,043.0	2,764.0	919.5	365.0	849.5	2,736.0	954.0	459.5	139.0	$1,595,802
Dec	1,398.0	3,396.5	1,408.5	647.5	1,191.5	4,419.5	1,388.5	813.0	232.0	$2,323,620
2017 Total Hours	14,904.0	34,670.0	11,763.5	5,406.0	12,323.0	34,857.0	13,032.5	7,074.5	1,750.0	
Cost Totals ($156/hr)*	$ 2,325,024	$ 5,408,520	$ 1,835,106	$ 843,336	$ 1,922,388	$ 5,437,692	$ 2,033,070	$ 1,103,622	$ 273,000	$21,181,758.00

*Cost estimate uses an average unit hour cost of $156.

a. % within 20 minutes
b. % between 21–60 minutes
c. % between 61–120 minutes
d. % between 121–180 minutes
e. % exceeding 180 minutes

Total hours of delay were approximated by multiplying the midpoint of each APOT- 2 value by the number of ambulance runs in that time interval and summed. To demonstrate the financial impact of offload delays on EMS systems, the number of delay hours was multiplied by an average value for unit hour cost in California. A Unit Hour is defined as the cost per hour of deploying a fully staffed ambulance for EMS response. An average value of $156 was used from calculated costs obtained from 5 different agencies.

Results

Data were received from EMS agencies representing 830,637 ambulance transports to 126 hospitals. This included 9 of 33 local EMS agencies in California that comprise 37% of the state population. Seven of these local EMS agencies are single county local EMS agencies. Central California EMS Agency and North Coast EMS agency are rural multicounty agencies. APOT-1 shows substantial variation by local EMS Agencies with many of the reporting agencies demonstrating APOT delays (Figure 1).

Offload times vary markedly by hospital as well as by region. Figure 2 shows data from a single representative local EMS agency (Riverside County) that demonstrates a high degree of variability by hospital. Several hospitals, but not all, demonstrate longer offload delays in the first and last quarter, which corresponds to the health system surge for respiratory virus season. Figure 3 aggregates data by hospital and displays APOT-1 in 5-minute intervals to provide additional detail of hospital variation. The majority of hospitals have a 90th fractile offload time between 15 and 45 minutes, clustered around the mean offload time of 36 minutes for the 2017 data. This also illustrates a bell-shaped curve skewed to the more extended offload times to the right. The increase at the tail of the figure after 60 minutes results from aggregation of these extended APOT-1 times more than 60 minutes. APOT-2 captures the extended values for offload delay, which account for relatively few transports but contribute disproportionately to the total time and cost of offload delays. Figure 4 examines counts of extended times and the percent of hospitals with at least one offload delay in each category. While Figure 3 demonstrates a relatively small percentage of hospitals with a 90th fractile greater than one hour, fully three-fourths of hospitals at times detained EMS crews more than one hour, 40% more than two hours, and one-third delayed EMS return to service at least once by more than three hours. The extended times, plus the frequent minor prolonged times add up to substantial time delay and cost to the EMS agencies. Table 1 shows the total hours by local EMS agency as well as the calculated cost for lost unit hours.

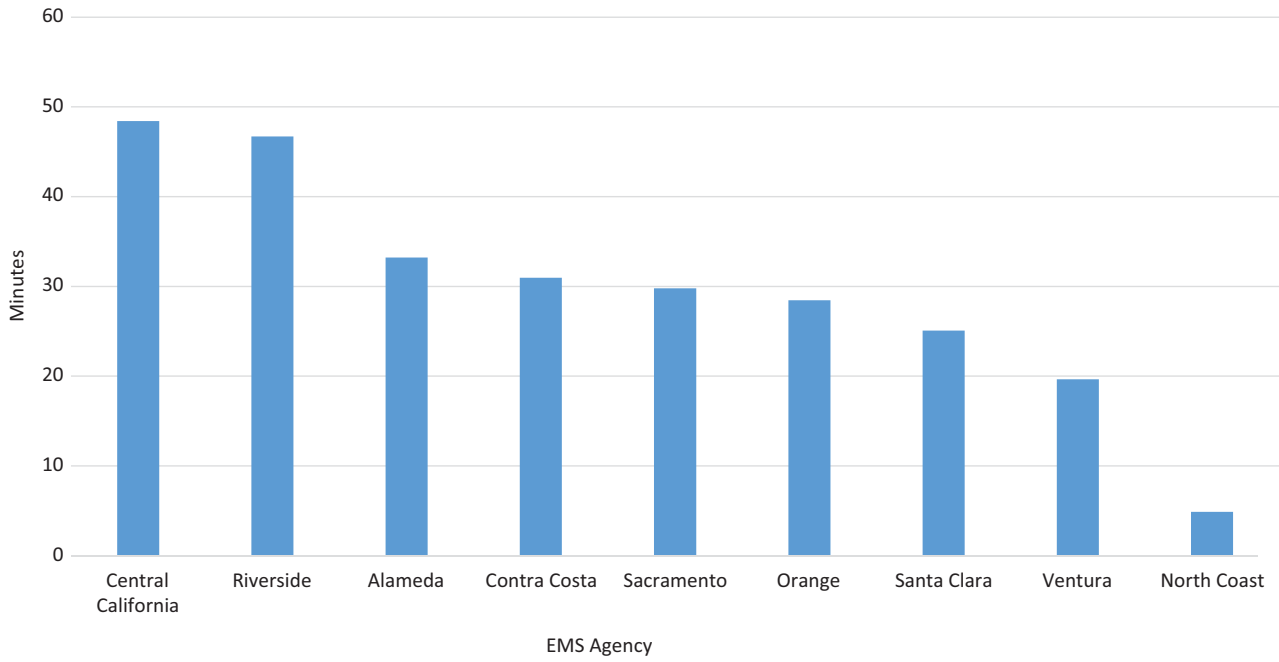

FIGURE 1. APOT 1 (90th percentile) of offload times by local EMS agency, 2017.

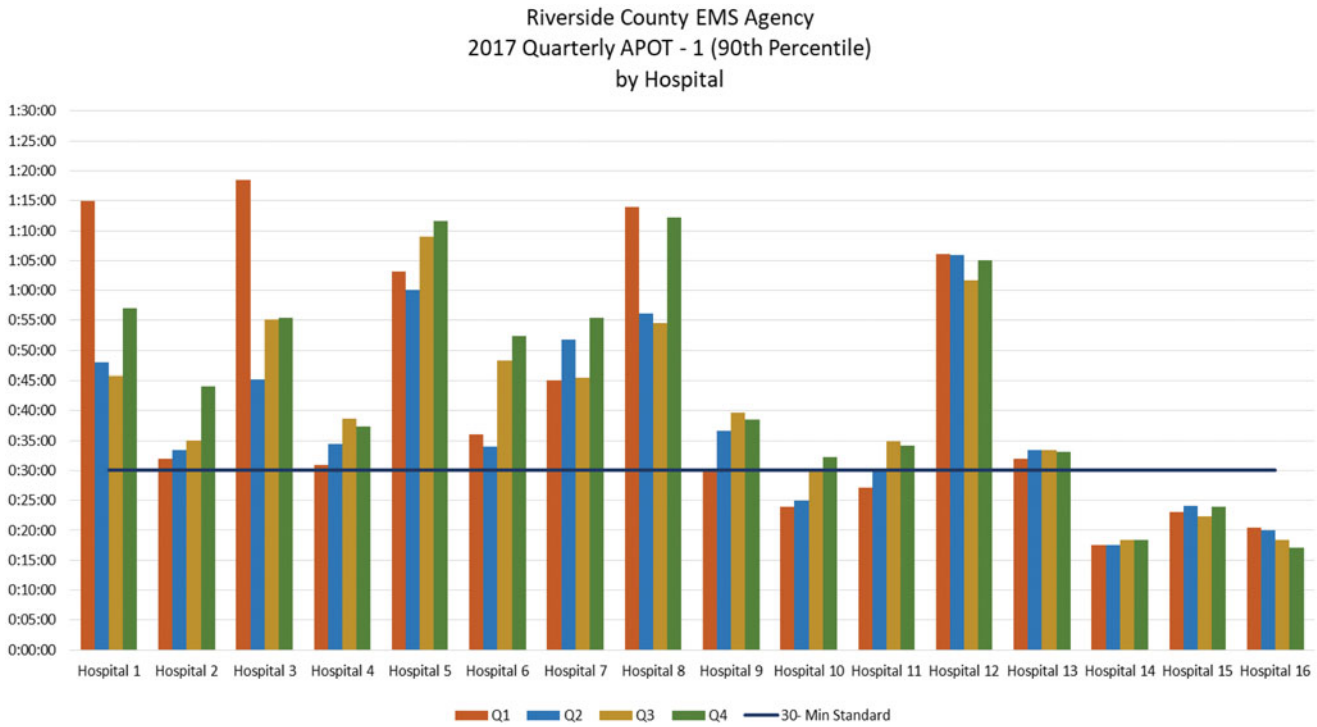

FIGURE 2. Ambulance Patient Offload Time 90th percentile in hours and minutes by hospital (deindentified) for each quarter of 2017 in Riverside, California. Standard accepted time is 30 minutes for this local EMS agency.

DISCUSSION

Ambulance patient offload time delays have significant operational clinical, economic, and customer service impacts to local EMS agencies. The development of a set of standard definitions and methodology in California to measure ambulance offload times allows consistent measurement of this phenomenon across multiple jurisdictions and EMS systems.

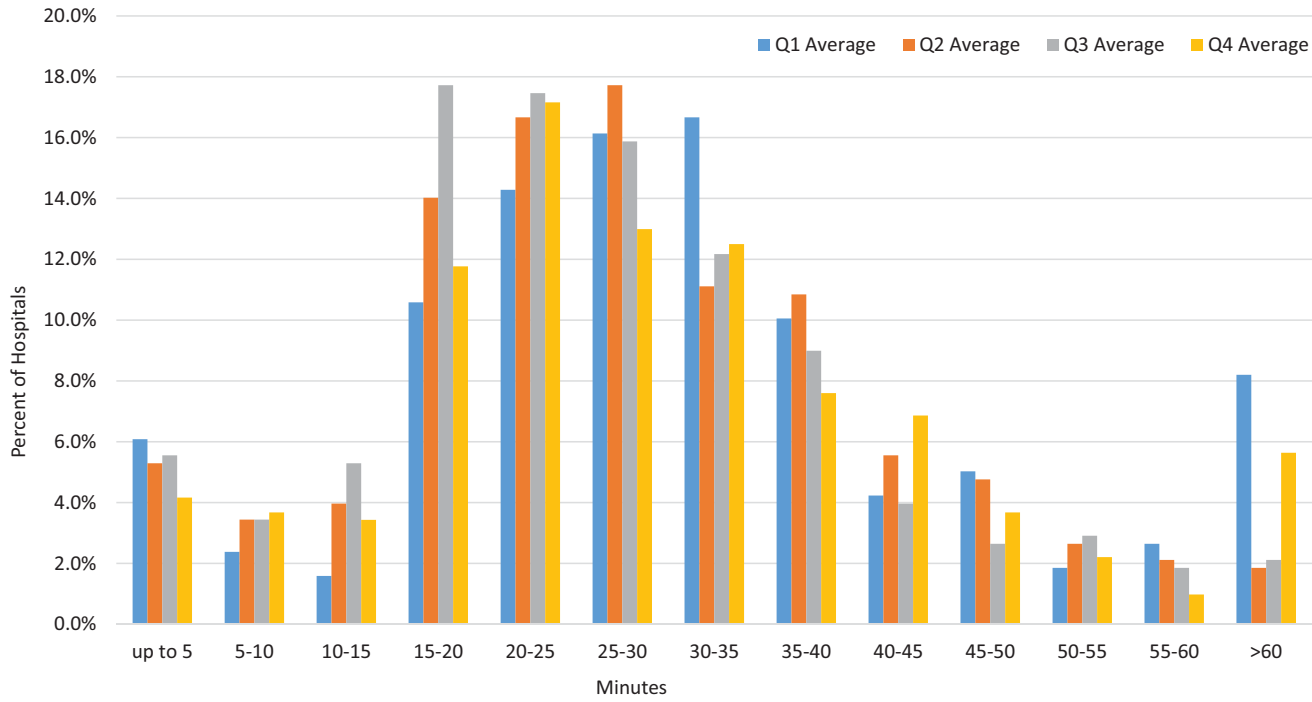

FIGURE 3. Percent of Hospitals (n = 126) in 5 minute intervals for 90th fractile of APOT 1 by quarter for 2017.

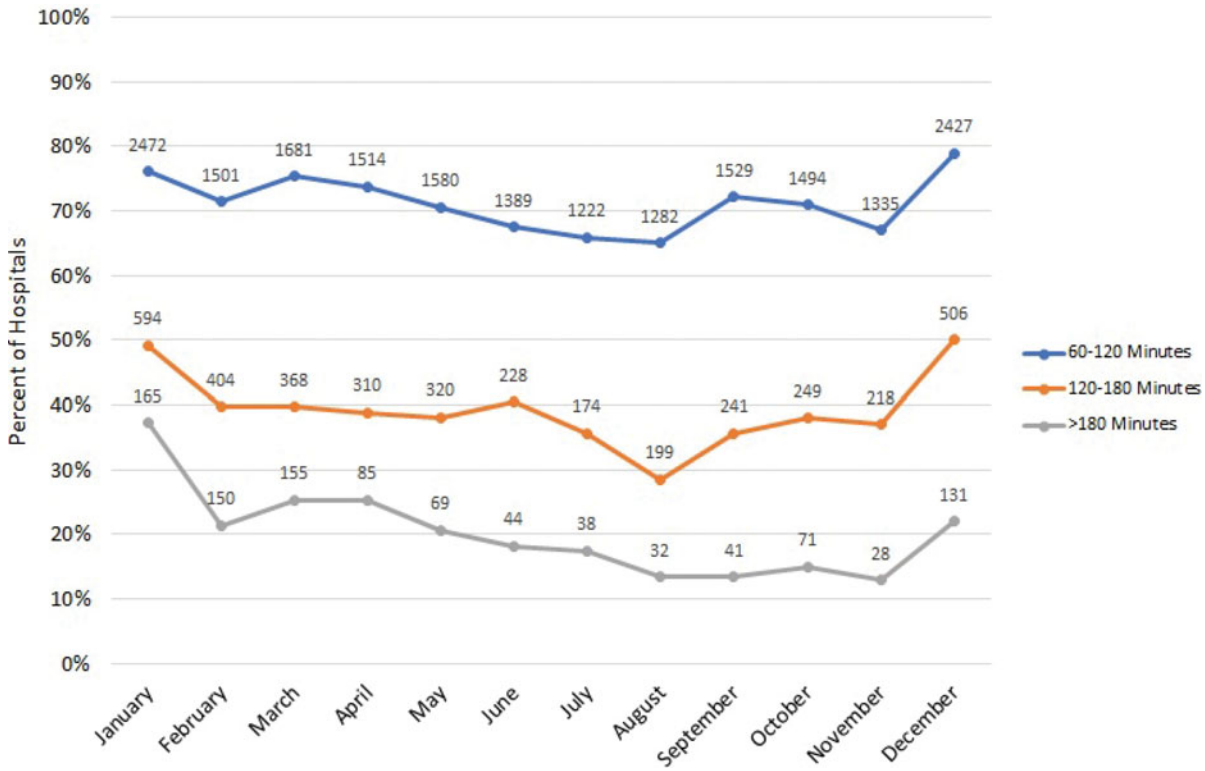

FIGURE 4. Percent of hospitals (n = 126) with at least one offload delay greater than 1 hour, plus the number of runs, by month, 2017

Our data demonstrate that there is marked variability in ambulance offload delay in California across jurisdictions and hospitals. APOT-1 demonstrates the day to day interactional status for an EMS system. Weighted averages for APOT-1 within a single EMS agency are heavily influenced by relatively few hospitals, as demonstrated by data from Riverside County. While a 15 minute difference in APOT-1 may seem

insignificant, the times add up over thousands of EMS runs and can have a large impact on response time in a busy jurisdiction, especially when multiple EMS units are waiting at one hospital to unload.

APOT-2 illustrates the prolonged offload times. These are a small percentage of cases but create extreme stress on the EMS system by tying up a staffed ambulance unit for extended periods of time. While some delays cannot be avoided due to system surge, they should be limited to short intervals and even in times of heavy system load should rarely exceed one hour. On occasion, ambulance units have been detained for six hours or more. We note occurrences greater than 3 hours but looked at aggregate counts rather than individual cases. Although APOT-2 extended delays account for a small percentage of calls and of hospital offenders, they contribute substantially to the high number of total delay hours.

Neither APOT-1 nor APOT-2 has a defined limit. The California statute left the definition of "standard" time, meaning the acceptable time, up to the local EMS agency. The EMSA set a time of 20 minutes for APOT-1 as the target benchmark. In a prior survey of the California local EMS agencies, the designated standard time varied from 15 to 45 minutes, with most selecting 30 minutes. There is no consensus standard time in the published literature or in position statements of U.S. medical societies and organizations. In contrast, the British National Health Service in association with their ambulance services adopted a standard for patient offload of 85% within 15 minutes and 95% within 30 minutes. There was a "zero tolerance" policy for delays exceeding 60 minutes (24).

Nevada State Legislature passed Senate Bill 458 in 2005 that created a standard of 30 minutes to transfer the care of patients from EMS to hospital staff (25). Other jurisdictions have policies supporting various transfer times. The Emergency Medical Treatment and Active Labor Act (EMTALA) does not provide a legal standard offload time. Moreover, EMTALA does not specifically define the transfer of responsibility or the "formal acceptance" of the patient from EMS to ED staff.

A letter from the Center for Medicare and Medicaid Services (CMS) from July 2006 stated that "parking" patients in hospitals and refusing to release EMS personnel jeopardizes patient health and impacts the ability of EMS to provide emergency services to the rest of the community (26). They suggested that this may result in a violation of EMTALA. A letter from the California Department of Public Health came to similar conclusions about the effect of increased turnover times on eroding the EMS response to community (27). CMS has been unwilling to specify a number that would trigger an investigation, stating that it must be considered in context of the other emergency needs at that hospital and demands for emergency care at that time. California AB 1223 provides an exclusion for periods of exceptional medical surge for "instances due to acts of God, natural disasters, or manmade disasters." While everyone would agree with accommodating fluctuations in system demand, the use of a fractile target should accommodate the frequent daily variations. The California Health and Safety 1797.52 and the California Code of Regulations (Title 22, Chapter 4, Section 100145) define the paramedic scope of practice, allowing paramedics to practice "while in the ED of an acute care hospital until responsibility is assumed by hospital staff"; however, this was not intended for routine or extended continuation of care for patients transported by EMS personnel once the hospital is responsible for the care of the patient.

Ambulance patient offload delay has little impact on the hospital; in fact, it works to their advantage by maintaining the California mandate for nurse-patient ratios and by cost-shifting from the hospital to the EMS agency who is supplying staff to monitor patients within the hospital. The number of ambulance unit hours is the largest operating costs for most ambulance providers.

APOT delay creates "lost unit hours" and disrupts otherwise appropriately resourced ambulance deployment and impairs system management adaptability. During peak times, multiple ambulances are frequently clustered at certain hospitals, unable to return to service. If uncorrected, this will degrade response time performance with serious impact on the community, especially critical patients requiring rapid response. Contractual penalties for prolonged response times add an additional financial cost from APOT delays. For transporting fire agencies, engines must be pulled into service from other stations, leaving fewer staff and vehicles for fire response as well.

There are multiple suggestions for how to approach this problem. One is to encourage voluntary performance improvement, which was the focus of the California Toolkit. Experience from many agencies and hospitals suggest that to reduce times, the effort must engage the hospital Chief Executive Officer, who is often not aware of the problem. Both of these efforts require data collection and sharing. California's experience, which is supported by our initial data, is that specific hospitals or entire health systems can adopt a successful policy to rapidly offload ambulances. There are other

examples of best practices and procedures to improve ED throughput and ambulance offload delays. Some EMS provider agencies now have their supervisor intervene at the hospital or call the hospital executive duty officer when an ambulance has been waiting for more than 1 hour. Since 2014, the Joint Commission requires that emergency department boarding times do not exceed 4 hours to protect patient safety and quality of care; although not yet demonstrated, this would likely have a positive impact on APOT (28).

Valley Hospital in Las Vegas (EM Xpress) improved patient hand-off by including EMTs based in the EDs to help transfer the patient physically off the EMS gurney while the paramedic gave report to the nurse who could initiate standing orders to the patient's workup (29). Other hospitals have the ambulatory EMS patients moved off gurneys to chairs prior to hand-off so that the EMS crew could begin cleaning and replacing their equipment while awaiting nurse availability. Some hospitals allow alternate destinations for EMS patients including Fast Track and Urgent Care capable of performing timely medical screening exams (MSE). Stationing a physician in triage to perform a MSE and initiate work-up has been proposed as a way to improve patient flow (4).

If reductions in APOT delays cannot be accomplished through an appeal to quality of patient care and public safety in the community, it may require contractual requirements, regulatory standards, and penalties. Nevada codified a standard offload time of 30 minutes, with review of extended times by a State or local advisory committee, but without any penalties imposed (25). In 2012, the British National Health Service set a "zero tolerance" policy for delays exceeding 60 minutes mandated reporting, investigation, quality improvement, and consistent financial penalties (24).

Reduction in APOT will ultimately require the collaboration of state and local EMS agencies, EMS provider agencies, emergency departments, and hospitals in an effort that incorporates hospital-wide coordinated strategies, data-driven management, and performance accountability.

Limitations

Compliance with providing APOT data to the EMS Authority was voluntary and there was some bias toward those agencies with worse APOT to participate. Data from only 9 of 33 local EMS agencies in California potentially limits the generalizability of this data. These reports aggregate data based on individual run data. It was the responsibility of the local EMS agencies to validate their results but was not overseen by the EMSA. APOT measures the time to turn over care of the patient and does not capture the total turnaround time for the ambulance. Unit hour cost estimates are not standardized and may include all direct and indirect costs.

This work does not provide additional information on the reasons for offload delay. We did not perform case reviews of extended delays to determine the proximate cause. Future analysis of these data will allow us to explore association of APOT with certain hospital characteristics such as size, population density, and payer's characteristics.

Conclusion

This first step to address offload delays in California consists of standardized definitions for data collection to address the significant variability inherent in obtaining data from 33 local agencies, hundreds of EMS provider agencies, and 320 acute care hospital emergency departments that receive 9-1-1 dispatched ambulances. The first year of standardized data collection of ambulance patient offload times revealed significant ambulance patient offload time delays that are not distributed uniformly, resulting in a substantial financial burden for some EMS providers in California. The next steps are to obtain data from additional agencies for a statewide assessment and to determine effective strategies to reducing ambulance offload delays in the hospitals that have been unable or unwilling to address the problem.

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